DOCKING OF A RIGID SPACECRAFT WITH UNRESTRAINED ORBITING FLEXIBLE STRUCTURE

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Purpose:

Establish a methodology for producing simulations of the docking of a rigid spacecraft with any unrestrained flexible structure.

Method:

Produce a detailed algorithm for the simulation of the docking of a rigid body with a nonuniform unrestrained beam.

Background:

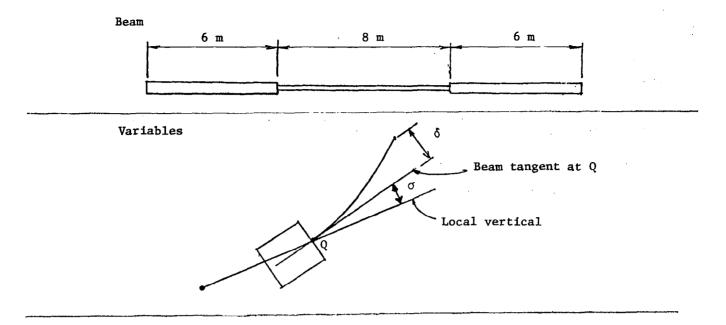
Predocking and postdocking motions can be simulated with algorithms given in references 1 and 2.

Tasks:

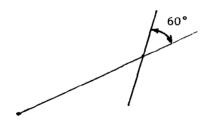
- (1) Determine the values acquired during docking by the variables characterizing the motions of the rigid body and the unrestrained beam.
 - (2) Transform to the variables used in connection with the cantilever beam.
 - (3) Perform simulations of the total process.

REFERENCES

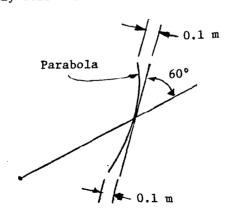
- 1. Levinson, David A.; and Kane, Thomas R.: Simulation of Large Motions of Nonuniform Beams in Orbit. Part 1 The Cantilever Beam. J. Astronaut. Sci., vol. 29, no. 3, July-September 1981, pp. 213-244.
- 2. Kane, Thomas R.; and Levinson, David A.: Simulation of Large Motions of Nonuniform Beams in Orbit. Part 2 The Unrestrained Beam. J. Astronaut. Sci., vol. 29, no. 3, July-September 1981, pp. 245-275.

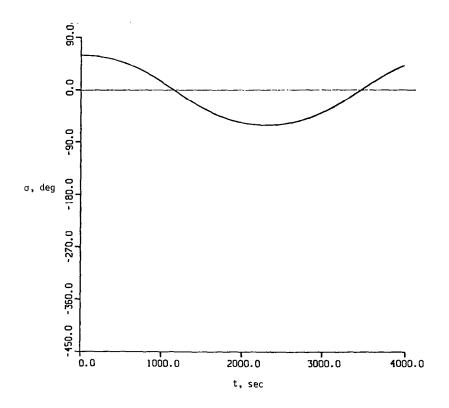


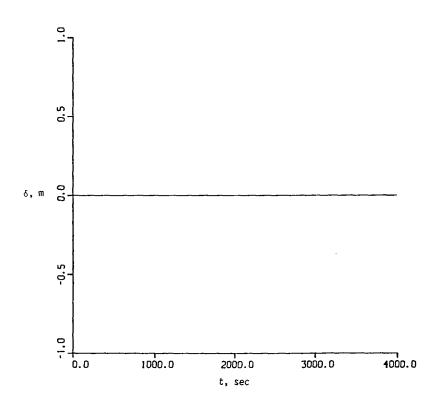
Initially undeformed beam



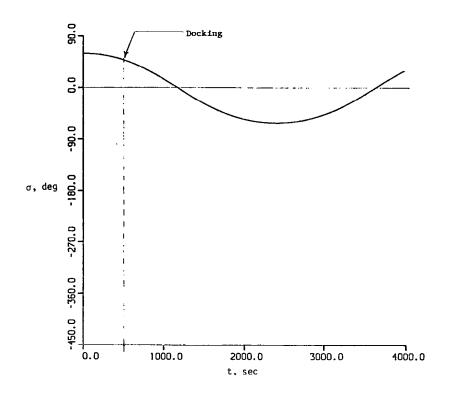
Initially deformed beam

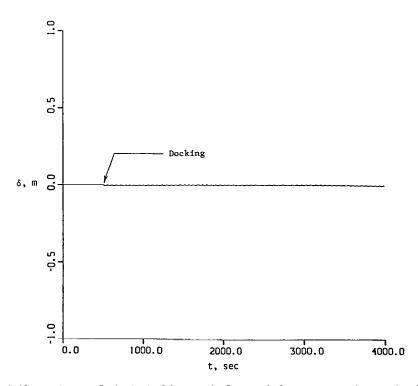




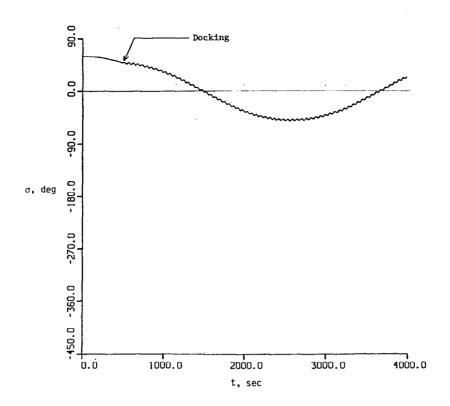


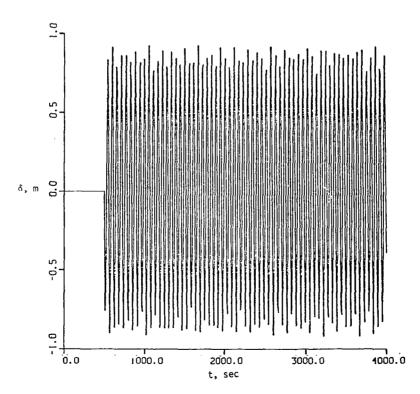
Libration of initially undeformed beam; no docking.



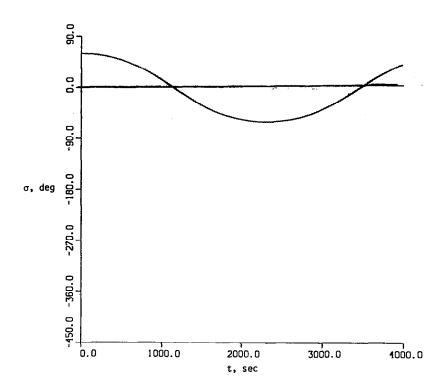


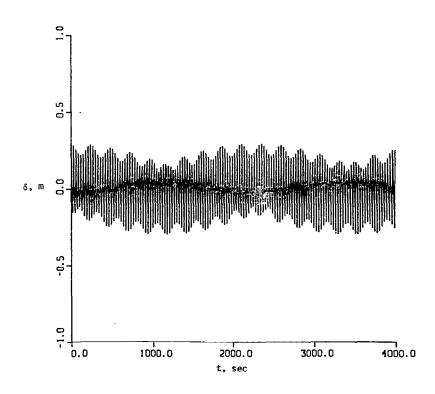
Libration of initially undeformed beam; perfect docking.



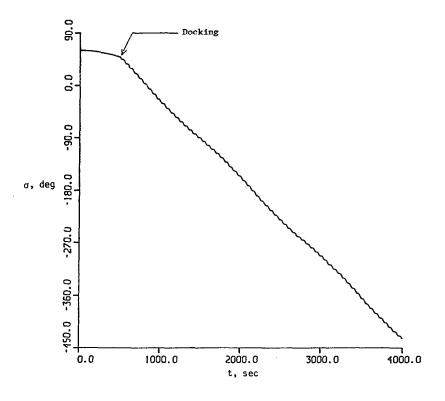


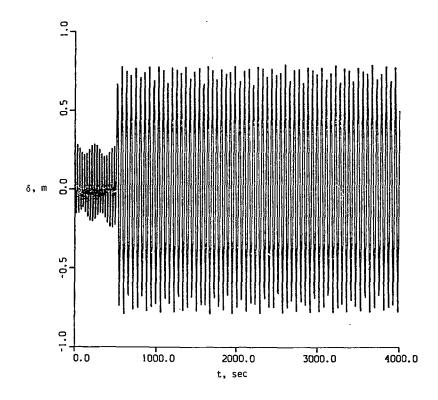
Libration of initially undeformed beam; imperfect docking. Velocity mismatch approximately 1 cm/sec; angular velocity mismatch approximately 0.01 rad/sec.



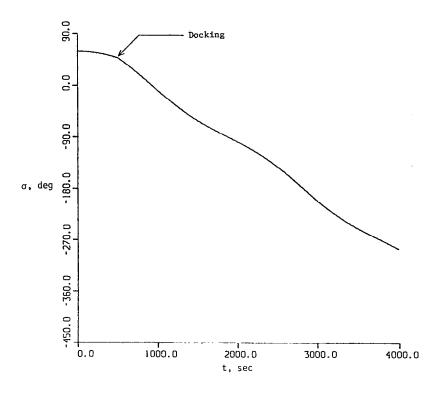


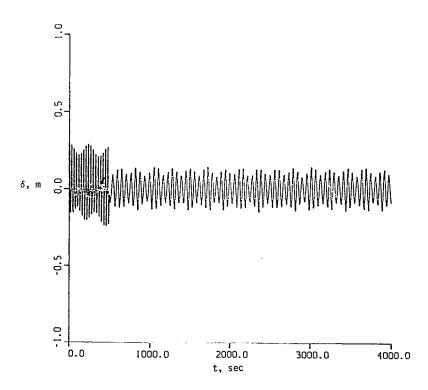
Libration of initially undeformed beam; no docking.



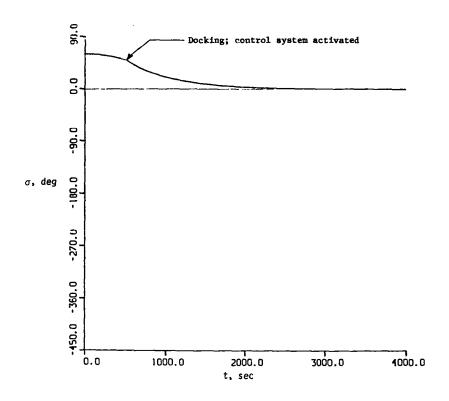


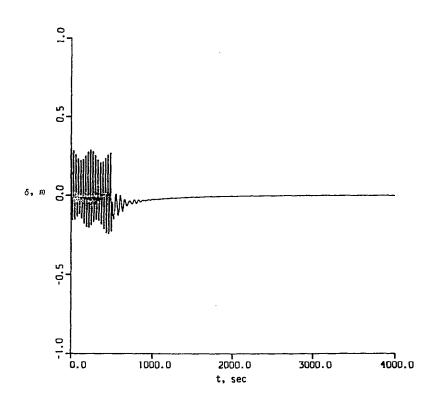
Libration of initially deformed beam; perfect docking.





Libration of initially deformed beam; imperfect docking.





Libration of initially deformed beam; postdocking control proportional to -o.